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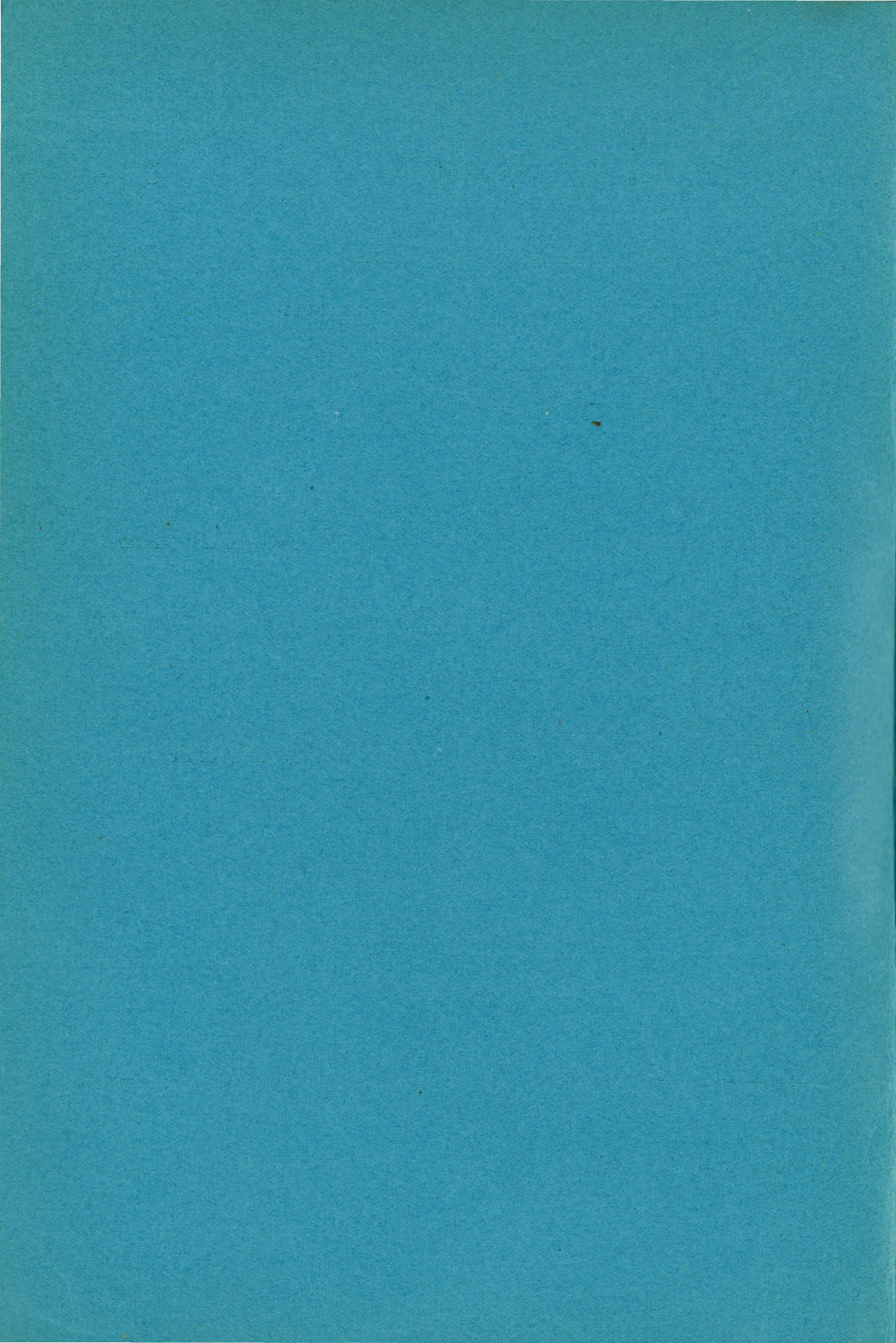
BULLETIN 202

GRAPE GROWING IN THE NIAGARA PENINSULA

BY

T. B. REVETT

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THE GRAPE GROWING INDUSTRY IN THE NIAGARA PENINSULA.

BY T. B. REVETT.

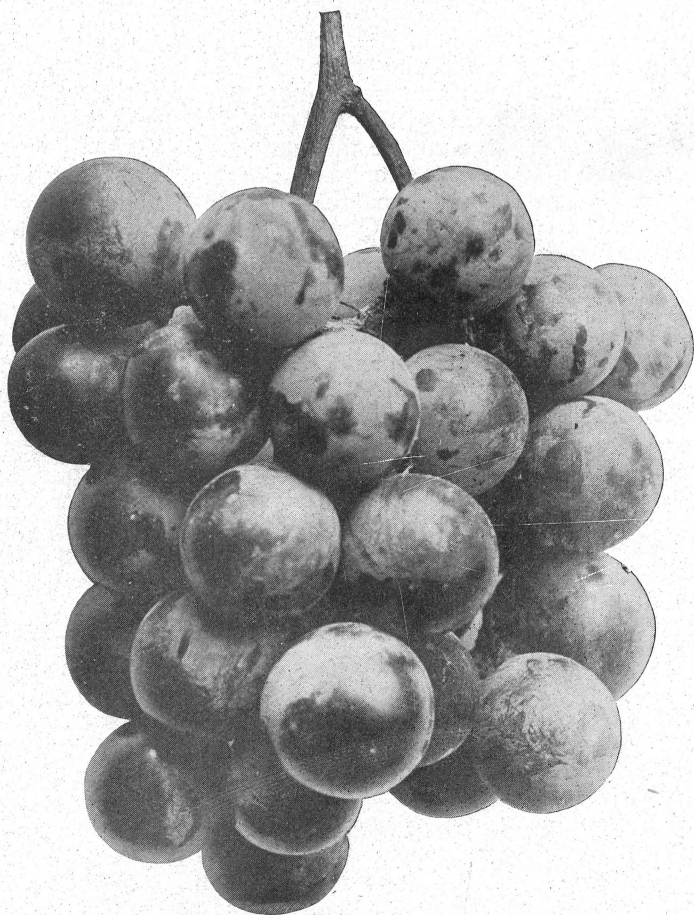
It is almost impossible to get any definite idea of the early days of the grape in the Niagara District. There seems to have been a few men who had planted two or three vines prior to 1860. In that year three plates of grapes were shown at an exhibition of native products held in Hamilton. These were supplied by Mr. Jonathan Pettit and Mr. W. D. Kitchen and a gentleman whose name could not be ascertained. These grapes attracted a great deal of attention, as they were probably the first Ontario-grown grapes ever shown at the exhibition. About 1857 some grapes were planted on a farm belonging to Mr. Porter Adams, situated in Niagara Township. In 1858 Mr. W. D. Kitchen and Mr. J. R. Pettit planted some grapes at Grimsby. In 1862 Wm. Read, of Port Dalhousie, planted three acres of Concord, Hartford, Prolific and Delaware. In the same year Peter Wright, of Stamford, planted three acres of Isabella grapes. In 1863 Messrs. Lusee, on the mountain near Winona, and J. M. Stewart, Henry Lottridge and Christopher Biggar, below the mountain, all planted small vineyards. In 1868 F. G. Stewart, of Stamford, planted $2\frac{1}{2}$ acres of Concord and Delaware, and P. Prest, of the same place, planted an acre of Delaware, Concord and Hartford Prolific, and in 1869 Walter Kerr, of Drummondville, planted 2 acres of Concord and Delaware, and Mr. Lowin, of St. David's, planted 2 acres of Concord. For the next six or seven years, as far as could be ascertained, very few grapes were planted. About 1880, however, by the introduction of the Niagara grape, a strong stimulus was given to the grape industry. Vines of this variety were sold at \$1.25 apiece, and the purchaser had to repay the company out of the first three crops, and was bound to sell all the wood from these vines to the company, and was not allowed to plant a single cutting, under a heavy penalty. In spite of these high prices and binding regulations, the vines yielded a profit of from \$2 to \$3 per vine for several years.

According to the late Mr. Murray Pettit, who was one of the earliest to grow grapes commercially, and who planted a Concord vineyard in 1872, and who was considered an authority on grapes, there were only

about 400 acres of grapes in 1880. In 1890 it had increased to 2,400 acres, with a production of 3,318.27 tons. In 1901 the acreage had increased to 5,750 acres, with the crop valued at \$20,000.00. From 1901 to 1909 the planting increased very rapidly, and after careful calculation the approximate acreage of grapes in the Northern District was found to be in the neighborhood of 10,000 acres. This tremendous increase was not due to any abnormal prices, but to the increase in number of fruit growers, and to the fact that it was found that grapes had proven to be a staple crop. The prices ranged from \$20.00 to \$22.00 per ton in 1909, as there was a tremendous crop, and as a result very few grapes are being planted this spring.

THE EARLY MARKETING OF GRAPES. It is interesting to note the gradual trend and development of the markets for grapes. Mr. F. G. Stewart, of Homer, told the writer that in the "seventies" he used to ship by boat from old Niagara-on-the-Lake to Toronto. Freight, wharfage and harbor dues at that time amounted to 18½c. per basket. These baskets had a capacity of twenty lbs., were made by Indians and sold at from 22c. to 25c. apiece, and used to be returned free from Toronto by the steamship company. Mr. Stewart said that in the "eighties" he netted as high as \$210.00 per ton for Delawares and \$140.00 to \$150.00 a ton for Concords. Mr. E. D. Smith, of Winona, who has been a long time in the business and is perhaps the largest grower and shipper, recalls the time when a few baskets of grapes were enough to supply the market, and it was thought that a few acres would glut the market. In 1872 the express companies started to handle the grapes and the fruit growers began to ship to Toronto and Montreal, and the tendency was to find new markets. After the introduction of the Niagara grapes the price for these grapes was 10c. per lb., or \$200.00 per ton. Since that time, as the acreages have been increased and distribution better handled, the consumption of grapes has been increased, yet the price has gradually been falling until it has reached the present low level, which varies from \$16.00 to \$22.00 per ton.

The gradual development of the markets, the better and more attractive baskets, the general keeping qualities of the grapes and the progressiveness of some of the shippers and co-operative associations have all lent themselves to developing the grape industry. In order to get some idea of the magnitude of the grape industry and its wonderful development in the last forty years one has only to consider that grapes are shipped by freight from the Niagara District to Vancouver in the west and Halifax in the east. The St. Catharines Cold Storage Company, which is a co-operative organization of growers in that section, shipped grapes to the West in 1904 under this Department's supervision; in 1905 Mr. R. Thompson, the manager, went West, and as a result of his trip 18 carloads were shipped; in 1906, 30 carloads were shipped West; in 1907, 45 cars; in 1908, 45 cars, none on consignment; in 1909, 90 cars were shipped to the western markets. With the development of the grape industry we also had a development of the wine industry. There



Agawam.

are five wineries in the Niagara Peninsula, which used 2,400 tons of grapes in the fall of 1909. There are also three or four factories situated in Toronto, Montreal and Sandwich, which are also supplied with grapes from this district. It has been found that under normal conditions about one-third of the crop of grapes is manufactured into wine. The buying for this purpose has usually been very brisk except during the last two years.

SOILS. The grape will thrive on a great variety of soils. In the State of Michigan the soil of the grape sections is a sandy one. In Southern Ontario and Pelee Island the grape soils are mostly sandy. In the Niagara district the grapes are grown on every variety of soil, from a light sandy soil to a very heavy, flat, red clay. In this district, however, the best grapes are grown on the mountain wash soils. This is of a loamy clay. It is a very deep, strong soil, and from year to year is kept fertile by the washing from the mountain. There is a strip of this mountain wash soil from Hamilton to Queenston, and its width varies from 100 to 500 feet. Toward St. David's, in the township of Niagara, we find the greatest width of this mountain wash soil, and with its advantage of earliness it must rank as the most ideal location for the growing of early grapes in the peninsula. The best soil for grapes, outside of special locations, etc., is a deep, rich clay or clay loam. When grapes are planted on these heavy soils they ripen their fruit better, and the flavor is much more pronounced and color better developed than grapes grown on sandy soils.

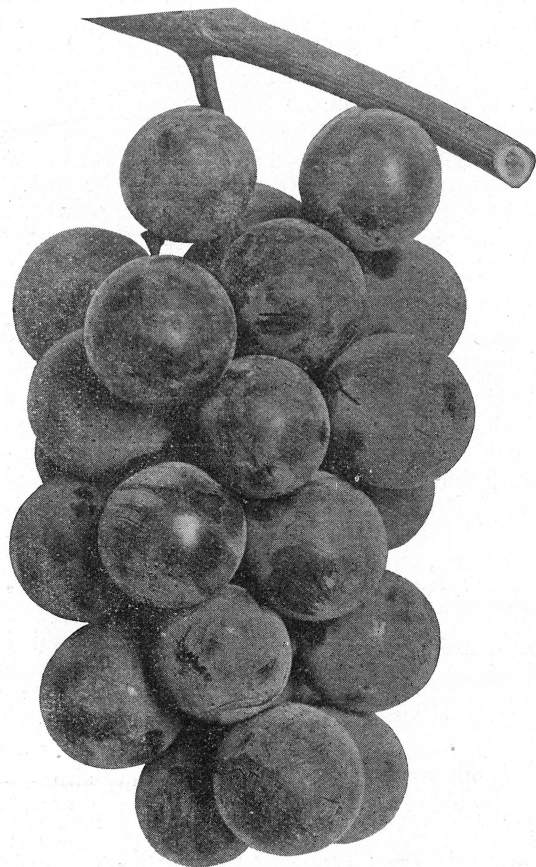
Grapes will also do well on a variety of the lighter soils, but it is hardly advisable to devote such lands to grapes, as these lands may be employed to a very much greater profit for production of other crops.

The soils for grapes in the Niagara district may be said to be the clay soils, as they are cheaper and better adapted to the most profitable production of grapes.

PREPARATION OF SOIL PREVIOUS TO PLANTING. The kind of treatment given to the cropping of land prior to the fall before planting is not very important. The chief factor to be kept in mind is the condition of the land to facilitate planting. A sod is not desirable because, in plowing out the furrows in spring, the result is that the sod is turned up. Grain or hoed crops are perhaps the best to use on land that is to be planted to grapes.

The land should be thoroughly plowed in the fall, and furrowed so as to insure good surface drainage. In the spring this land should be thoroughly worked down with disk and cultivator, and should be gone over twice. While the vines may do well on the land that has not been thoroughly worked, yet the grower should always endeavor to have the soil in the best shape possible.

TIME OF PLANTING. Vines should not be planted until the soil is dry enough to work without puddling. If the vines are planted when the soil is wet, the soil will become caked around the vines from planting, which is very undesirable. Planting may be done from the 1st of May



Vergennes.

to the 24th. Many of our best growers prefer to be late in planting and have good soil conditions, and they claim that the vines do just as well as early plantings.

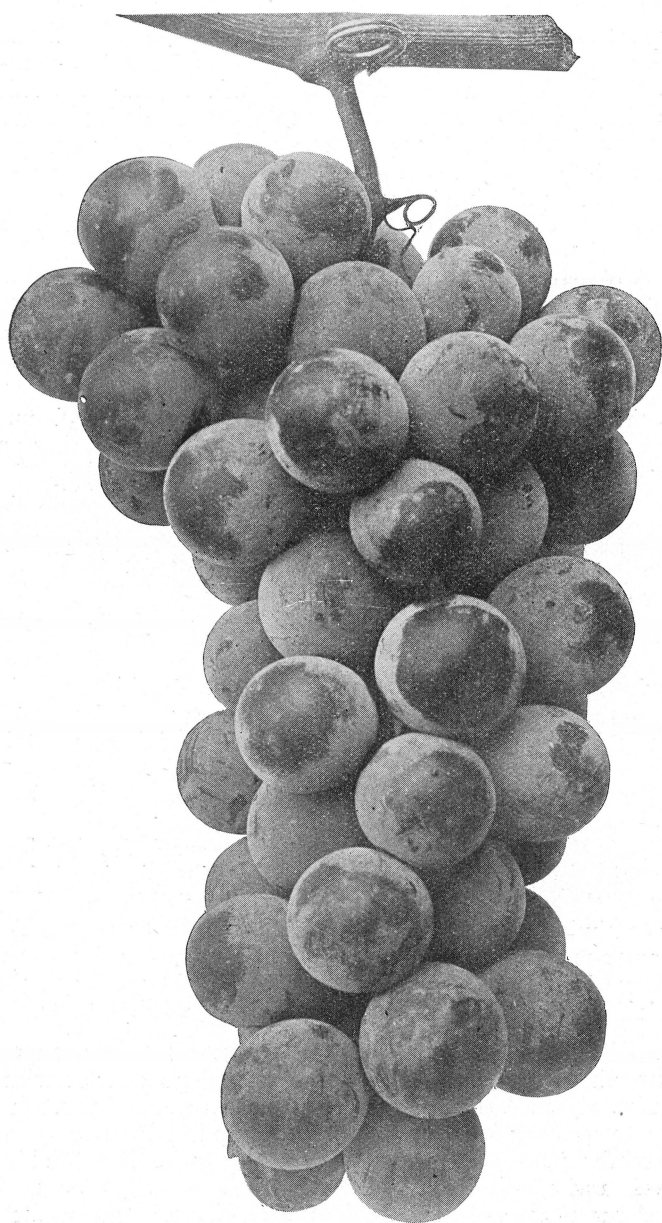
DISTANCES APART IN PLANTING. The distance apart in planting a vineyard, or the amount of feeding space to be allotted to each vine, depends almost wholly on the kind of soil, and to some extent on the method of pruning. In rich, deep clays—in fact, in all deep, heavy soils—the space required by vines is much less than in sandy or lighter soils. In light, sandy soils it is recommended to plant your vines 10 feet apart each way, *i.e.*, the rows will be 10 feet apart and the vines 10 feet apart in the rows. This gives adequate room for the development of the vine.

In the heavier type of soils some of the growers recommend the rows to be 10 feet apart and the vines 9 feet apart in the row. This is a good conservative distance, and, for the average fruit grower, is perhaps more adaptable. In instances, however, where a grower has land which by some outstanding feature is peculiarly adapted to the production of grapes, such as would probably be situated at the foot of the mountain, and the grower has made up his mind to give some special attention to this vineyard, it might even be advisable to plant his rows 10 feet apart and have the vines 7 or 8 feet apart in the row. With this close planting it would be possible to get the most out of the vineyard, but at the same time a great deal more attention would have to be given to the pruning.

One of the best grape growers in the Winona section said that he thought it would be a very good plan to set out a vineyard closer and to remove the intermediate vines after a period of five to six years, thereby increasing the yield per acre up to the time of removal, which would considerably lessen the cost of establishing a vineyard.

This method, however, could be practised only where the vines were planted 9 to 10 feet apart in the row, and when vines could be purchased at $2\frac{1}{2}$ c. apiece. It is a question whether it would be advisable to recommend it, as the grower would find it very hard to remove the intermediate vines, and if they were left too long a lot of injury might be done to the vines which would eventually form the permanent vineyard.

KIND OF VINE TO PLANT AND ITS PREPARATION. Nearly all the fruit growers buy their vines from the nurserymen, and very few, if any, grow their own. The nurserymen gather the wood from the vineyards as soon as they are pruned, and make the cuttings from the good, thrifty wood with sound buds. The base of the cutting is clipped off just below the bud, and the end just an inch or so above the third bud. This gives three buds to a cutting, and the cutting is about one foot long. These cuttings are tied in bundles of from 100 to 300 in a bundle and layered in the soil, standing on end with the buds turned upside down. This is done to stimulate the callousing and formation of roots. In the late spring, when the soil is in good shape, a deep furrow is made, and the cuttings are set in this furrow from three to five inches apart, in rows four to six feet apart. These cuttings are cultivated and kept free of weeds, and make an excellent growth. Those cuttings that have made



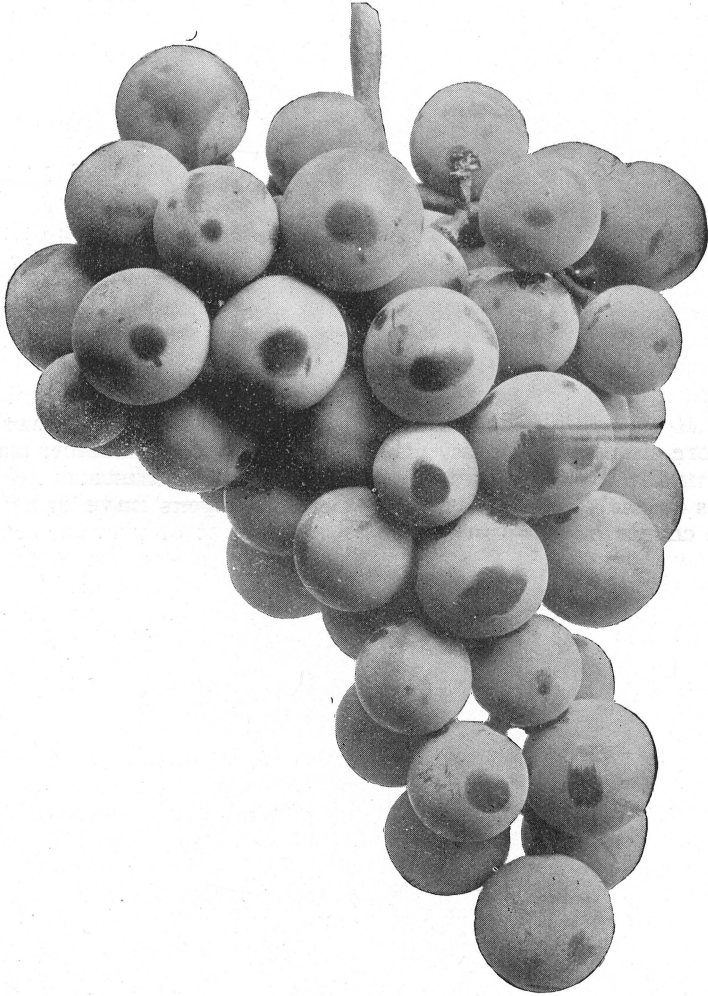
Campbell.

a strong growth are sold the following spring as No. 1 one-year-old vines. Those vines that are not sold are replanted and are sold the following year as two-year-olds. There are perhaps some cases where the cuttings are allowed to grow two years and then sold as two-year-olds.

With the above knowledge the grower will be able to decide that the one-year-old vines are the proper ones to plant. This is the consensus of opinion amongst the best vineyardists, for they claim that a two-year-old is nothing but a one-year-old cull that has been replanted. However, there is one factor which has been suggested by one of the growers which would have some influence on the age of vines to be planted. He claims that some varieties are slow growers, and that better results are got from planting two-year-old Worden instead of one.

The usual precautions should be taken in ordering, *i.e.*, the varieties should be given, and you should request that no substitution should be made. The order should be mailed as early as possible, as the nurserymen fill their orders according to the date of receipt of same. The quality of stock required should be plainly stated and the age given. If these precautions are taken there should be no trouble in obtaining your stock. As soon as the vines are received the bundles should be cut open, and the vines heeled in and mounded up to three-quarters of their length. Care should be taken to keep varieties separated, and any simple device will do this. The place in which the vines are heeled should be protected, if possible. When the soil is ready for planting the vines may be trimmed up by cutting back the wood to three buds. There is some diversity of opinion in regard to the cutting back of the roots. Some growers believe in cutting them back two-thirds. This may be done with sharp spade or hatchet when the vines are received in bundles. In this way a lot of time is saved, and the slight difference in the evenness of the roots does not appear to make any difference. One very successful grower told me that he only removed the injured parts of the roots except in cases where they happened to be over twenty inches in length, and he claims that he could not desire better results. Another grower claims that he cuts back the roots liberally, but he finds that with the system of planting by a furrow the roots take a long time in getting hold of the middle of the row, and that most of the energies seem to be spent in the direction of the furrow. In order to obviate this he cuts two of the roots that are opposite to short spurs from one to three inches long, and in planting these roots should extend towards the centre of the rows or at right angles to the furrow, and he claims by so doing the roots develop in all directions.

SPRING PREPARATION OF LAND FOR PLANTING. As soon as the land is dry enough to work, disk it thoroughly and go over it with a spring tooth cultivator and work it down until it is in good shape. It is almost necessary to go over it twice. When the land is in shape and the time has arrived for planting, the marking out has to be done. This is a very simple task, and requires a good plowman and a steady team. The rows are staked out at the proper distances apart at each end of the field, and by the use of two or three rods, depending on length of row, the plow-



Concord.

man strikes out a deep furrow of about six inches deep and returns in the same furrow. This plan has been found to be very successful by many growers, and all that is needed in planting. On the other hand, some of the growers prefer to strike out a furrow, and on the return strike out another, leaving a dead furrow between. This is plowed out on the third turn and deepened on the fourth turn. This method is longer, more expensive, but gives a somewhat better condition for planting. It is, however, a question which the grower must decide for himself, and will depend entirely on the amount of time at his disposal.

PLANTING. As soon as the furrow has been made the planting should be started, and should follow up the plow all the time. A rod cut to the desired length, which is the distance apart of the vines in the rows, is used to show the position of vines. A boy carries a bundle of vines which have been trimmed for planting, and one man does the planting. In planting, the root should be arranged carefully and the earth firmly tramped. The vine should be set so that the two or three buds are just above ground. One cannot be too careful in having the earth firmly packed around the roots, as perhaps more dead vines are due to this defect than anything else.

When a lot of vines are to be planted, two men are used, and a boy supplies them with the vines. By utilizing the second man the work may be more quickly and efficiently done. In some instances another man follows up the planting and fills in the earth to a distance of about eighteen inches on each side of the vine. Some growers have found that by applying a couple of handfuls of bone meal at the time of planting better results were obtained. The bone meal is not thrown on the roots, but is scattered about them before the earth has been completely filled in. When the field has been planted the furrows are filled in by using a disk. The disks are set at such an angle that each section will pass on the side of the row of new planted vines. This is by far the best machine to use, as it pulverizes the soil and fills in the furrow beautifully.

FIRST YEAR MANAGEMENT OF VINEYARD.

As soon as the vineyard is planted it should be kept cultivated, either with a disk or spring tooth cultivator, and the ground should never be allowed to bake or crust. Cultivation should continue until about the 1st of August, when the vines should be left to mature their wood. In the fall it is well to plow and furrow out the vineyard in order to afford good surface drainage. However, all that appears to be necessary in the way of fall plowing in so young an orchard is two or three furrows on each side of the row. By this I do not mean to imply that the fall plowing of the whole vineyard is not to be recommended. In hilly lands or any lands situated in such a manner that there is a considerable wash in the spring, I think it would be greatly advisable to abandon the plowing of the whole vineyard and only plow two or three furrows up to the vines, whether the vineyard be young or old.



Moore.

There is one vineyard I know of which is situated at the foot of the escarpment, and the water runs straight down the rows. In this vineyard the above practice is, and has been, followed for several years with excellent results.

MULCHING OF YOUNG VINEYARDS. Mulching of young vineyards is practised by a great many growers, and seems to be a commendable practice, because, besides manuring the vines, it acts as a protection and mulch. Good, strawy manure is used, and two forkfuls are generally applied to each vine.

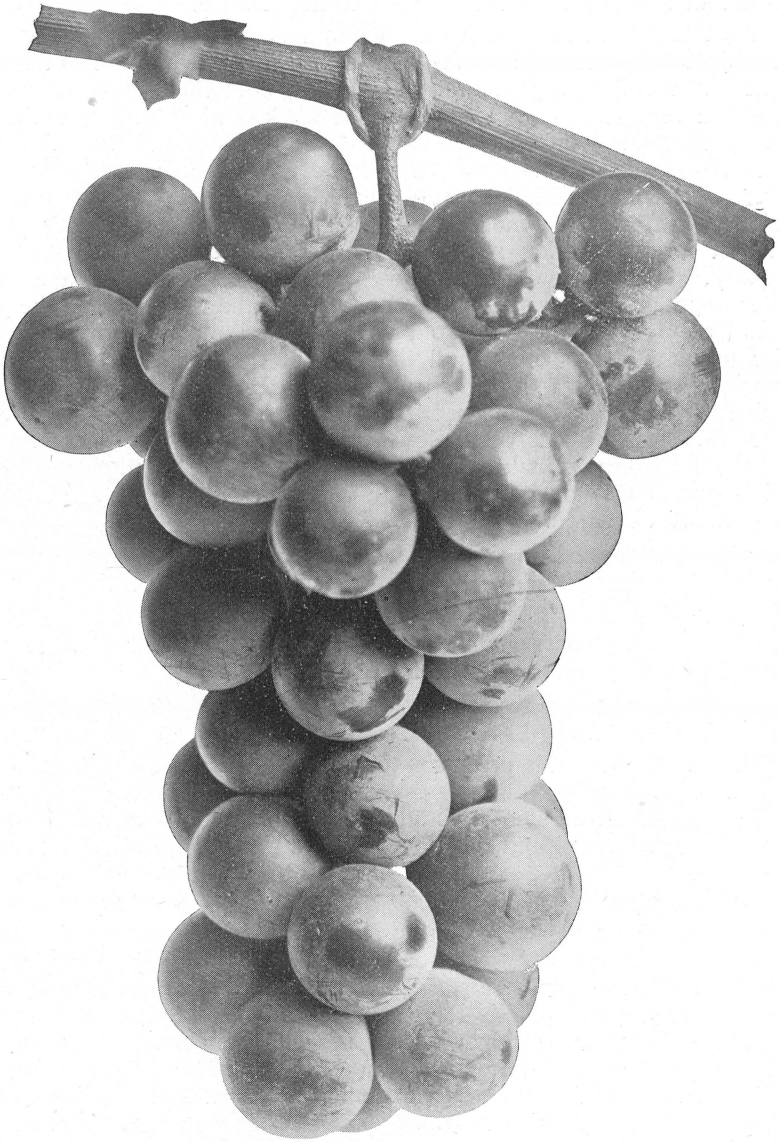
CROPPING OF ONE-YEAR-OLD VINEYARD. The question that naturally arises is, will a systematic cropping injure a young vineyard? It seems almost obvious that the plants do not require the whole of the feeding surface for their development during the first year, yet nearly every grower seems very skeptical on this point and almost invariably ends by giving his opinion, which is not very favorable to cropping, and his ideas must have been formed either by personal experience or observation. However, it stands to reason that if the land is needed it will in no way injure the grapes if the vineyard is cropped, but a distance of three feet should be left on each side of the row, and only those crops which will not shade the vines and are hoed crops should be used. I would not recommend the use of corn, as it does not permit free circulation and shades the vines too much. Tomatoes, potatoes and roots are probably the best to be used in cropping a young vineyard. I have always observed that the great drawback to inter-cropping was the lack of appreciation by the grower of the fact that if he inter-crops he must also fertilize and endeavor to carry on such a rotation that will improve rather than deteriorate the soil. If this factor were more faithfully observed there would not be so many discouraging opinions with regard to inter-cropping.

SPRAYING. It is not usually found to be necessary to spray a one-year-old vineyard, but should any insect attack it, poisoned Bordeaux mixture should be used. It is very little trouble to spray such a vineyard, and the expense is almost infinitesimal, and it would be a good precaution to spray the young vines after they had made their first growth.

RUBBING OFF OF BUDS. Two buds were left in the first instance, in order to insure a sprout, and in case one sprout was destroyed there would be another to take its place. As soon, however, as the growth has attained a length of from 10 to 15 inches, select the best shoot and remove all others. This will strengthen the growth.

PRUNING.

SECOND YEAR MANAGEMENT. The method of cutting back in the second year varies greatly. Many growers desire to maintain their first year's straighter growth. However, taking all things into consideration, I would advise following out the method of cutting back to the second bud. By



Worden.

doing this the growth is greatly stimulated, and, as a general rule, the wood that is formed is of a strong, healthy texture.

CULTIVATION. As soon as the ground is dry enough it should be plowed about three inches deep. In many cases it may be noticed that some plowmen, while doing this work, will hold their plow at an angle. This is a very bad practice, because the work done is very uneven. The heel of the plow is up and the point down. This makes the furrow to a small degree V shaped—one part of the furrow being deeper than the other. The plow should be held squarely and an even furrow plowed, and the work will be more thorough and uniform. A gang plow is the best for this work. It does the work more evenly and with greater rapidity. After plowing it will be necessary to use the grape hoe, in order to get as near as possible to the trunk of the vine. While the young vines have not yet taken full hold of the ground allotted to them, it is not wise to plow very deeply, and thereby cut the surface roots. This is especially so in well-established vineyards, as in these the roots have extended very far and should not be ruthlessly destroyed by deep plowing. After the vineyard has been plowed it should be disked and cultivated, and the cultivation should be kept up until the 1st of August, and in the fall it should be plowed as in a one-year vineyard.

CROPPING. While it may prove successful if a proper method of cropping was carried on the first year, I think it is highly undesirable to crop during the second year, as I believe that full attention and every advantage should be given the vineyard from now on.

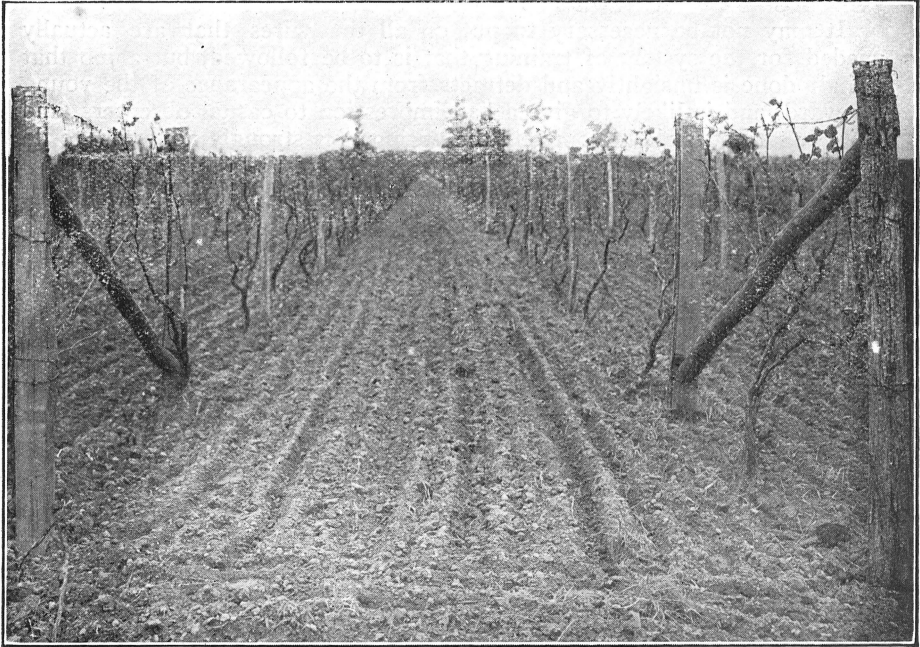
MULCHING. The system spoken of in the first year's management is a good one to follow and is giving good results.

TRELLISING. The work of putting in your posts and starting the trellis should be started.

POSTS. Good cedar posts should be used. For the end post the post should be longer than others, and not less than five inches in diameter, while the intermediate posts should be about three inches up. The posts should be well cured and not dead. If your posts are good they should last at least twenty years. If the butts of the posts are painted with tar they will keep very much better. The posts should be set about thirty feet apart and from 2 ft. 9 in. to 3 ft. in the ground.

SETTING END POSTS. The end posts have to be set more firmly, as they have to bear a greater strain. There are several methods of setting and guying the end posts. The usual method is to make the post hole deeper and larger, and to nail a cross bar on butt of post. This is done to keep post from heaving. Some heavy stones, if handy, are advantageously used as the first filling. Care must be taken that the filling is well rammed. The post is then guyed with strong wire (galvanized). The wire is secured to the post about a foot from the top; the other end is attached to a large stone, which is buried about three feet deep and as near to the post as possible without decreasing the relative ratio of the purchase. This distance is about four to five feet. The wire is tightened

by using a stick and twisting the wire. The greatest objection to this method of guying the end post is the waste that is occasioned. The wire interferes with cultivation, wastes a lot of land and is conducive to slovenliness. However, this method is the best method of guying or giving the necessary strength to the end post by use of an outside support. Many of the new vineyards have been guyed on this principle, only the wires have been attached from the top of the end post to the base of the first post. In some cases a wooden brace between the end and first post is used, and is very effective.



Ends of grape trellis, showing method of bracing posts.

Another method of setting an end post, which has been strongly recommended by one of our best growers, and which appears to be evidently acceptable as it does away with the guying, is "setting the post in cement," and is done in the following way. A large hole is dug, the bottom of which is made very much larger than the top, and the ratio of increase of diameter of hole increases very rapidly at the bottom. This is done with the idea that if the soil is not disturbed the rigidity is greater, and by shaping out the bottom the cement foundation will be more rigid. In preparing the post for setting a cleft is cut on each side, in order to give the cement some hold on the post. It may even be beneficial to attach a cross bar to the bottom of the post. The post is then

set in position, and the cement is filled in and well rammed, in order that it will thoroughly fill the hole. The filling is continued until you have a cement foundation about a foot thick. The cement is left exposed for a few hours, and then the hole is filled in usual method. This method of setting in cement is more expensive, but the headrow of the vineyard is easily kept clean, as there are no wires in the way, and again we invariably have the rusting and breaking of guy wires, which are tedious and expensive to replace.

WIRE AND WIRING. It is a good plan to get the best grade of galvanized grape wire. No. 9 staple wire is the usual size in use.

It may not be necessary to put on all the wires that are actually needed for the system of training that is to be followed, but a job that is half done is unsightly and detracts from the appearance of the young vineyard, and is likely to give a bad impression to casual observers, and if it is at all possible to complete the wiring it is strongly advisable to do so.

The wiring of the posts is a very simple thing. In wiring of end post one of the many plans for tightening the wires has to be followed. There are some simple devices which are attached to the post, and the wire is tightened by turning a crank. A very simple method in use is a piece of hardwood about an inch square and six to eight inches long. The wire passes through a hole in the post and is attached to the stick, and to tighten the stick is just turned round, and the tautness of the wire, together with the shape of the "tightener," keeps it in place. In stitching the wire the spool is placed on a spindle at one end, and a man takes the wire to the other, where it is tightened and fixed in the same method as the first post. The wire is then fastened to the post by staple.

DISTANCE APART OF WIRES. The distance apart of wires depends entirely upon the system of pruning. When only two wires are required, the first wire should be $2\frac{1}{2}$ ft. from the ground, and the second or top wire $2\frac{1}{2}$ ft. from the first. Where three wires are used the first wire is generally 18 inches to 2 ft. from the ground, and the top wire 5 ft. from the ground, while the third wire is halfway between. In cases where four wires are used, the first wire is from 15 to 18 inches, and the other wires evenly spaced off, the top wire being 5 ft. from the ground.

TRAINING OF TWO-YEAR-OLD VINES. In many cases the training of these vines is neglected; but this is very wrong, as it is desirable to obtain as straight a trunk to the vine as possible, and this can only be done by training during the second season. The chief training to be done is that of the main shoot, which should be tied up to second wire as soon as its growth permits.

SUMMER PRUNING OF VINES. The only summer pruning to be done in a two-year vineyard is to rub off all the buds or shoots from the main stalk from the ground up twelve or fifteen inches of the trunk. This is done to strengthen the trunk and keep it clean and even.

MANAGEMENT OF A THREE-YEAR-OLD VINEYARD.

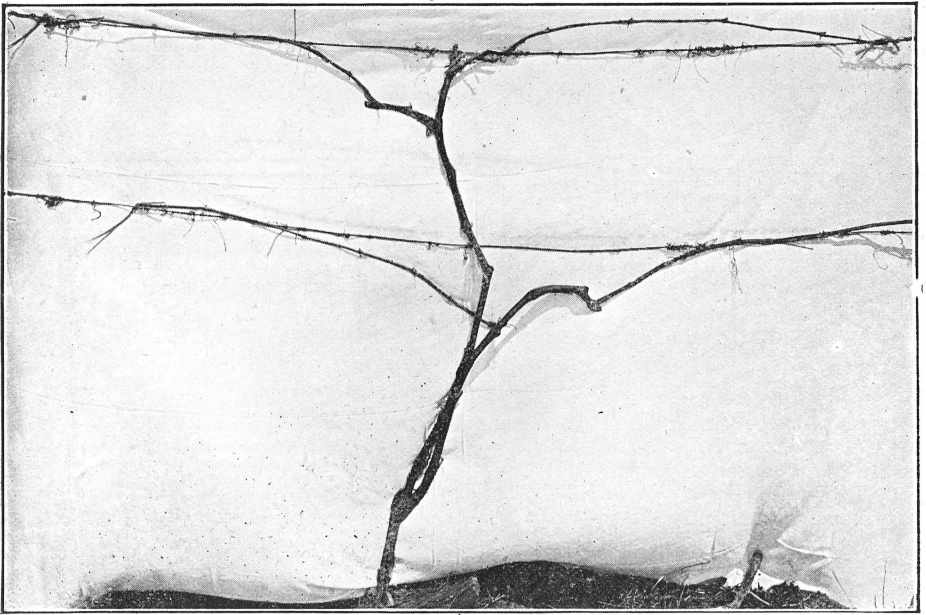
In the third year a vineyard commences to bear and the general routine of work is practically the same as all other years, the cultivation,



Old Kniffen System.

which consists of fall and spring plowing, and a thorough harrowing of the soil. The use of the grape hoe becomes more necessary, and some of the growers attach a small one-horse cultivator to the grape hoe, the cultivator taking the place of the shear of the grape hoe. This makes

a very handy tool for working up to the vines. In the fall the soil is plowed up to the vines and in spring away from them. It, however, cannot be too fervently expressed that proper and frequent cultivation must be given the vineyard in order to get the best results, and the cultivation must stop about the latter part of July in order to induce the vines to ripen their fruit and mature their wood. The most important thing in the third year of a vineyard, and perhaps of all the preceding years, is the pruning and training, and this feature will be taken up after the discussion on the different methods of training grapes as the pruning closely hinges on the methods adopted.

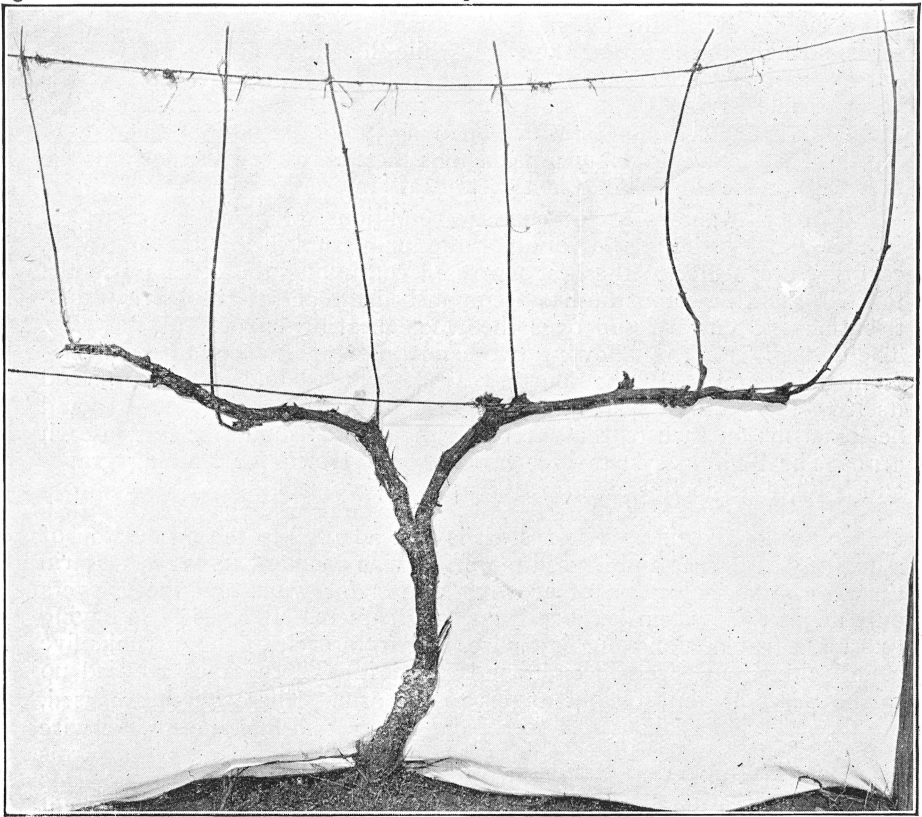


Improved Kniffen System, showing the method of dividing trunk of vine.

METHOD OF TRAINING GRAPES. There are six methods of training and trellising grapes to be found in the Niagara Peninsula. They are as follows:—

1. The Kniffen system.
2. The Arm system.
3. The Fan system.
4. The High renewal system.
5. The Arbor system.
6. The conglomerate and do as you please system.

THE KNIFFEN SYSTEM. This system of training grapes is perhaps the most common, especially in the neighborhood of St. Catharines and towards St. Davids and Queenston. It consists of a central cane with four arms and is trained on two wires. This system is greatly recommended by some of the best growers, especially in cold sections and on sandy or light soils. Its chief advantage is that it permits of thorough ventilation. It is generally cut back to seven buds to each arm and four



Arm System.

arms to a vine, which gives fewer bunches than other systems, but these fill out and ripen better, and there is not as much tying up. The Kniffen system is admirably adapted to the production of market grapes of the best quality but the yield of bunches is not as great as in the other systems.

In pruning for the first and second year the vines are cut back to two, or three buds as previously described. In the third year one arm is

trained along the first wire, and if possible a second arm is trained on the same wire. The second arm is generally from the first. The probability of securing a second arm may be increased by leaving a spur at the proper point during the second year pruning. The main shoot is carried up to the second wire. The grower should endeavor not to crop his vineyard too heavily, and from twelve to fifteen buds are quite sufficient to be left, the others should be rubbed off. With this system there is virtually one central trunk with a side arm at the first vine from which the two arms are eventually taken. It is claimed that in this way the flow of sap is straight to the top of the wire, while the canes on the first wire do not get as much nourishment and they do not as a general rule give the best possible results. This argument may be substantiated if the size of the trunk is any criterion by which one may judge the ratio of the flow of sap, because it is invariably noticed that the size of the trunk from the first wire to the top of vines is a great deal larger.

In order to ameliorate or equalize conditions, Mr. F. G. Stewart, of Homer, devised the plan of dividing the main trunk below the first wire, carrying one trunk to the first wire and continuing the other up to the top wire, and he claims he has accomplished the act of more evenly distributing the flow of sap over the whole bearing surface of the vine. The division is got by allowing two canes to grow at about fifteen inches from the ground. In the fourth year the vine should have conformed itself to the Kniffen system, and in pruning in the spring there should be two arms on each of the wires and seven buds should be left to each arm. The Kniffen system is a very desirable form for training grapes and is highly recommended by a great many growers.

THE ARM SYSTEM. The system is best adapted to the production of a quantity of grapes and is used more for wine production, but in Ontario there is no specialization of growing grapes for wine, and the growers only adopt this system because it appeals to them. It consists in having two main trunks along the first wire, and from each of these trunks five canes with from seven to eight buds are left. These canes are tied up to the wires at almost right angles to the arm. Three wires are used, the top wire being about five feet from the ground and the middle wire evenly spaced. In the second year the vine is trained in two arms along the first wire and in the third year it is cut back two or three buds to the arm, and the fourth year four or five canes are left which are cut back to five or six buds.

FAN SYSTEM. This system is admirably adapted for the production of a quantity of grapes. It is easily pruned and gives an even distribution of wood, and next to the Kniffen system is more generally used in the district than any other. It is not advisable, however, to adopt any system which has the tendency to induce over bearing, especially in late ripening varieties, as this might result disastrously in cases of early frosts. Besides, when over-production is prevalent we have an improper ripening of wood, and as a result winter killing of the canes. This system

is very prevalent between Hamilton and Grimsby, especially in the Winona District.

HIGH RENEWAL SYSTEM. This system seems to be a moderated type of Fan and Arm systems. Its chief value is the evenness of distribution of wood, the apparent simplicity in pruning and the excellent results it has given around Winona, especially on the mountain wash lands. It is used by Mr. E. M. Smith, who recommends it very highly. In the



Fan System.

first year the vine is pruned to two buds. After they have grown about ten inches break off one cane. The second year cut back to two buds again (if vine is weak save only one cane); train to first wire. Third year train to first wire and tie vine so that it is taut (vine should be twenty to twenty-four inches from ground). Rub off all buds below one foot from ground. Fourth year run out two canes along first wire and centre cane to second wire and cut off all canes to six or eight buds.

ARBOR SYSTEM. In this system the vine is cut back in the first and second year to two or three buds, one shoot being retained each year. In the third year the vine is run up to the top of arbor, which is built about five to six feet high. The vine is then trained along the top of arbor, and every year the wood is renewed and about thirty buds left to bear. Outside of home vineyards, which are trained in this manner in order to lend an appearance of beauty to the garden, there is only one commercial vineyard trained in this manner and the grapes are grown for wine. This vineyard is situated at St. Catharines and is the property of one of the large wine-making companies.

THE CONGLOMERATE AND DO AS YOU PLEASE SYSTEM. This system, I am sorry to say, appears quite frequently in the Niagara District and the adjacent country where grapes are grown. It may or may not be the result of carelessness, but the chief cause is the lack of definite knowledge of the methods of training, and also the employment of trimmers that are not conversant with any definite methods or reason for methods which they may practise, the chief idea being to remove a portion of last year's growth. In these cases we invariably find that too much bearing wood is left on the vine and the net result from such conditions is that the vineyard presents an uncared for appearance, the fruit is much harder to pick and the bearing wood recedes further each year from the main trunk. There is no special method of training these vines, as this system is liable to be found on any kind of trellis.

PRUNING. Pruning is one of the most important factors in successful grape growing. On it depends the even distribution of wood, the limitation of the crops, the quality of fruit, the development of bunches and the ripening of same and the general appearance of vineyard. The majority of growers understand the importance of pruning. They realize that wood must be renewed but have not arrived at some specific ideal of training, which goes hand in hand with pruning. Too often men are hired to prune the vineyard, and probably a different man every year, with the result that the best results are not achieved, and in many cases the shape of vines destroyed. No definite plans can be laid down for pruning, and several things have to be taken into consideration which are local and call for personal observation and experience. The ultimate object of pruning is to produce the best fruit, to keep the vines in a desired shape, to control the factor of bearing and to facilitate all necessary operations in the production and harvesting of fruit. The vineyardist must bear in mind that it is within his control to limit the number of bunches to be produced by any vine in his vineyard. With this factor under his control he should use his judgment in pruning. He must study his varieties and their methods of bearing and ripening. For instance, those varieties that are late in ripening should not be allowed to bear too heavily, for this is conducive to late ripening, and very often we find late ripening and productiveness hand in hand. The amount of fruit which a vine can bring to maturity with the best results depends upon the fertility of the soil. This is another factor which receives too

little attention by the growers of the Niagara District, and it too often happens that because somebody, who may have entirely different soil both in regard to physical character and fertility, leaves so much bearing wood on his vines it must be right for somebody else to do the same. The only way to determine the amount of bearing wood to be left on your vine is by observing the crops and their quality. A vine that is young and inclined to be small and lacking vigor will not improve by over-bearing and should be cut back more severely. It must be borne in mind that the proper number of bunches to a vine should be just what the plant will be able to fill out properly and mature. It is better to have fewer bunches and better ones. It is a general plan to allow from twenty-eight to thirty buds to a well-grown vigorous vine. One factor which must bear strongly on the number of buds to the vine is the distance. Vines that are planted closely should not be allowed so many, but the aggregate production to the acre will be more. The fundamental principle of pruning grapes is based upon the following fact that the fruit is borne in a few clusters near the base of the growing shoots of the season which spring from wood of last year's growth. The number of bunches that are borne on these growing shoots vary from two to five, according to the variety. This feature will be taken up in the discussion of varieties.

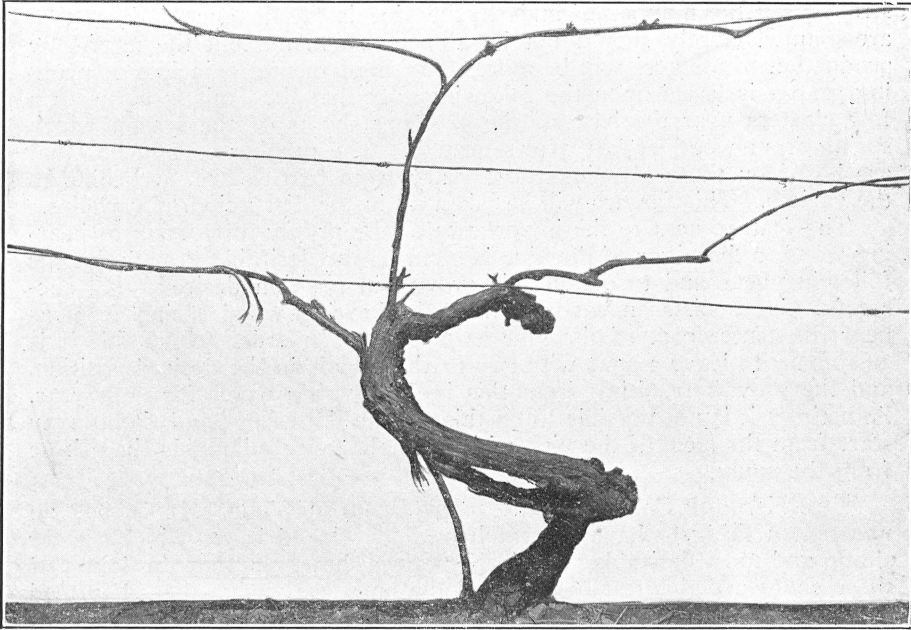
The feature next to the importance of the proper proportion of bearing wood to the vigor of the vine is securing the desirable growth for the following year and to obtain this growth in position desired. All successful vineyardists endeavor to have the bearing wood spring from as near the centre part of the vine as possible. In order to get this it is customary to leave a spur with two or three buds in the desired position, and the growth resulting from this is the bearing wood for next year. Sometimes it is not possible to do this and on the other hand shoots may start from the stem of the vine which may be more adaptable than those from the spurs.

THE KIND OF CANE TO SELECT FOR BEARING WOOD. It is not an uncommon thing to have extremely well developed canes which appear plump and most desirable. It will be noticed, however, that the joints of these canes are abnormally long and the buds are wedge-shaped instead of being round and plump. The best growers avoid the selection of these canes, which they call "Bull canes," and claim that they do not produce as good bunches. One grower, however, informed me that he tried an experiment with some of these bull canes and could find no difference in the productiveness and quality of fruit. It would be advisable, however, to retain those canes which are characteristic to the variety and well developed and have round, plump buds.

TIME OF PRUNING. In the Niagara District it does not seem to matter at what time during the dormant season that grapes are pruned. It has come to be an established fact that pruning of vineyards may be started in January and finished by March. It is best to have the same man do your pruning from year to year, and if more than one man is employed some responsible party is generally placed in charge of the work. After

the vine has been pruned the trellises are cleared by cheap labor. Trimmings are thrown in the centre of the row and are gathered in the spring and burnt.

In gathering the trimmings a pole from 12 to 16 feet in length and $2\frac{1}{2}$ to 3 inches in diameter at one end and slightly smaller at the other end is used. It is best to have the largest end, which is the one that draws along the ground, slightly curved at the end. A horse is used to drag the pole and the whippetree is attached by means of a chain or rope to a point about four or five feet from the ground end of the pole. The driver holds one end of the pole and proceeds down the row. The pole soon



Method of renewing old vineyard, showing a two-year-old cane which will take place of old trunk at next pruning.

collects the trimmings, which are heaped at the end of the rows and burned. Some of the growers use a spring tooth cultivator for this work with a great deal of success.

SUMMER PRUNING. Summer pruning is not recommended as a general thing. Some of the growers shear back the vigorous growth if it is shading the fruit too much. In some varieties, such as Champion and Vergennes, sprouts will very often appear and fruit many small ill-shaped bunches. These should be removed. It is also a good practice to remove any vigorous growth which may sprout up from below the first

wire. However, if one is about to renew his vine it is well to select one of these shoots sprouting from the collar of the vine and train it.

PRUNING TOOL. The ordinary clippers is all that is required for winter pruning. Unnecessary growths in early summer are best rubbed off with the hand, and the pruning back of vigorous growths is usually done with a pair of large hand shears.

RENEWING OLD VINEYARD.

A system of renewing is sometimes adopted in vineyards that are very old or in vineyards that have been disfigured by improper pruning. In order to renew a vine a shoot coming from the ground is protected and in pruning the first year it is cut back to the first wire. The second year it is pruned according to the system of training, and part of the old vine is removed. In the third year the pruning is carried out as the second year but your wood on this new vine would probably enable you to train it on the upper wires. This year some more or the whole of the old vine is removed according to the vigor of its successor. This plan is very good because no crop is lost in the renewing of the vine, and when the old vine is discarded the new one is in full bearing. It is sometimes hard to get a new shoot from the ground, and while the majority of growers wait for their opportunity to secure a sprout one of the growers claims that he gets good results by ringing half way round the base of the old cane. This ringing causes the formation of sprouts, from which one is selected.

TYING. In the spring the vines are tied up with strong grape twine. A woman will do this work very handily. The twine should be wrapped twice to three times around the wire, make one knot and then tie up cane. This method of tying does not cause slipping and allows room for expansion of cane.

FERTILIZATION. To get the best results from a vineyard the soil must be fertile. In rich wash soil situated at the foot of the mountain the grapes do well with practically no manure or fertilizer. This is evidently due to the fact that a good deal of fertility is washed off the mountain on to these lands every spring. The majority of the heavy clay soils and the loamy soils need manure, especially the clay soils, the physical texture of which is far from being ideal, and good applications of barnyard manure would be very beneficial.

Within the last two years a great many of the growers are applying barnyard manure. They, however, make the great mistake of applying it around the trunk of vine instead of spreading it over the row where the feeding roots can get at it. While a good application of barnyard manure will give excellent results, it must be remembered that it contains more of nitrogen than of the other constituents of plant food, and too heavy and frequent applications would be apt to stimulate too much growth. An application of from six to nine tons per acre every three years should give good results.

COMMERCIAL FERTILIZER. The use of commercial fertilizer is becoming more common amongst the fruit growers. Many of them claim that by its moderate use good results are obtained, providing the soil is in good physical condition, especially on the lighter soils. Mr. F. G. Stewart, of Homer, recommends the following application: Rock phosphate 400 to 500 lbs., potash 100 lbs. per acre sown broadcast. In buying fertilizer the grower should never buy a mixed compound but should buy the ingredients and mix it himself, and in doing this he saves money and knows exactly what he gets. There is no definite rule in regard to the amount and kind of fertilizer to use. This depends entirely on the soil and its condition. The grower, therefore, should experiment for himself and he will be able to know definitely what is needed and the quantities that will give him the best possible results on a minimum expenditure.

COVER CROPS. The use of cover crops is primarily to incorporate vegetable matter in the soil, and when nitrogenous crops are used they also incorporate nitrogen in the soil. The secondary function of the cover crops is to hold the snow. The greatest drawback in a cover crop is that it makes it very wet picking the fruit. Nitrogenous cover crops are not often used in vineyards. The chief crops used are rye, oats and barley. These are sown early in the summer and plowed under early in the fall to facilitate picking. In some cases rye is sown in the fall at the rate of one to one and a half bushels to the acre and plowed under in the following spring just when the grain starts to head.

HARVESTING.

Never pick your grapes until they are ripe. During the past years there were growers who have been extremely eager to obtain the highest market price for their grapes, and to do this they pick their grapes without the slightest regard for the ripeness. Their whole endeavor is set on getting to the market with grapes before anyone else, and incidentally to palm off on the unsuspecting public an article not fit for hog feed, much less human consumption. If there were only individual cases of this fraud being practised it would not be so bad, but the neighbors see the grapes going to market and the temptation seems to be almost irresistible and we find growers all over shipping green grapes. Ask them their reason and they will reply that the other man is doing it and getting the high prices. What is the result of this marketing of green grapes, and who does it affect? The answer to the first question is very apparent. The consumer gets the green grapes and decides that either they are green and unfit to eat and that he has been cheated or that he has lost his taste for grapes, and what is the result? A falling off in consumption. The good prices that are obtained on an early market do not last long and the growers suffer. This regrettable feature should be eliminated and the growers should do everything in their power to stop themselves and their neighbors from selling green grapes. Grapes do not require to be picked before they are ripe in order that they carry well.

On the other hand they carry better and keep longer when they are picked ripe.

The question may then be asked, when is a grape ripe? A grape may be said to be ripe when it has received its full development of color and flavor.

PICKING OF GRAPES. The picking of grapes is mostly done by women. The grapes are picked directly from the vine and put in the baskets, which are placed when full on the shady side of the vine to be picked up later by the wagon. The bunches should be ~~handled as carefully and as little as possible~~, in order not to rub off any of the bloom. The bunches are severed from the vines by means of grape plyers. This little instrument is very much like a pair of scissors, but the blades are very small. A knife should not be used, as it necessitates holding the bunch more firmly, and the act of cutting the stem with a knife requires a forward pull which tends to bruise the bunch. The stem of the bunch should be cut short, about an inch to one inch and a quarter. Any dried or green berries must be picked out with the fingers. The bunches are then placed in the baskets so that they are not loose. Those bunches forming the top layer of the basket are placed stem downward which gives the basket an attractive and finished appearance. The baskets are usually covered in the field and taken to the packing shed, where they are hooked. The baskets used are either six or eight quart baskets, and cost about \$34 per thousand. There are several other packages which are more or less fancy and could be used to advantage for high class trade, such as the crate which holds four three-quart baskets. These make a very attractive package, but the market for such packages is very limited at the present time, though there is no doubt that it may be worked up.

MARKETS.

The markets for the grapes of the Niagara District include the whole Dominion of Canada. Our grapes are being sold from Vancouver to Halifax. The great drawback seems to be improper distribution and underselling. Like every other commodity the grapes have to be sold at a certain price in order to be profitable to the grower. It is the last crop the grower has to market, and the fruit comes in in great quantities and very rapidly, especially towards the end of the season. The result is that distribution has to be very perfect in order to market the crop without glutting any one market. The present state of marketing is far from perfect. There are six co-operative societies, three large buyers and many small buyers shipping independently, and the result is an unsteady market. The grapes have to be disposed of quickly in order to move the crop, and the buyers must sell at an advance of $1\frac{1}{2}$ cents per basket in order to make a small margin. In the face of daily increase of grapes the buyers and associations have to find a market. For instance, last year's crop was marketed to the great dissatisfaction of the grower and in several cases to the loss of the buyer. The grape crop was a very heavy one. The wine manufacturers only bought about one-third of their

usual purchase, and in spite of the fact that green grapes had been sold in large quantities, which discouraged the early markets, the consumers were taking a tremendous quantity of grapes. The price was falling rapidly and many of the growers had to be satisfied with 10c. per basket, while the average price was not above 12½c. per basket. Several reasons were given for this demoralizing state of affairs. The great cry was that the French Treaty had caused the wine manufacturers to curtail their purchases almost one-third, and that there was an over-production of grapes. These factors no doubt played a very important part in producing the crisis, and the effect will tend to stop the planting of grapes to a very great extent. Some growers justly claimed that the promiscuous selling of green grapes lowered the average price to a great extent and they were unquestionably right. However, these causes do not seem to answer sufficiently for the prices of grapes. The markets did not seem to be glutted in any case, and the consumer had to pay the usual price per basket even in Toronto. While grapes were being bought at from 10 to 12½c. per basket from the grower the consumer in Toronto was paying from 18 to 28c. for the same article, and yet we know that the buyers in the fruit district lost on their grapes. There seems only one explanation, namely, that the buyers have been underquoting their competitors, even below the margin of cost, and that this system was greatly intensified in view of the large crop and the rapidity with which it ripened. To the average onlooker who had no knowledge of the industry a simple remedy would be to amalgamate the interests or to have some working basis on which prices should be based. The first suggestion has received a great deal of thought, but would be an extremely hard plan to consummate. In this market there are individual buyers and co-operative associations consisting of the growers themselves, while the buyer buys the grower's produce and expects to make his profits, and it would hardly be acceptable to the buyer to have such close relations with the farmers through their associations. If such a proposition could be established it would greatly ameliorate the conditions of the grape market and would be the greatest boom to co-operation that Ontario has ever seen or even dreamed of and would mean a tremendous increase in the membership of the co-operative associations. To the average public such an organization would be greeted with a great deal of awe and disfavor and the cry would immediately arise that a monopoly existed and the price of grapes would immediately be raised and maintained. This, however, would not be the case. Grapes are perishable and have to be consumed within a short period, and the consumption decreases rapidly with the advent of cold weather. The main object of this amalgamation would be to fix a uniform price for grapes, starting from the early varieties down to the end of the season. Such an amalgamation would mean that the distribution would be more even, the grapes would be better packed and handled and the green grape nuisance would be more conveniently held in check.

The second suggestion, that the associations and buyers should get together and fix a ratio of prices which would be rigorously adhered to

seems to be a very admirable one at first thought. This has been tried, with the result that the quotations were not adhered to and a merciless cutting of prices was instituted and the growers had to foot the bill, especially those who had not contracted their grapes beforehand.

The different parties who are interested in definitely doing away with the present unstable and unprofitable state of the grape industry have had several meetings already with but little result, but it is hoped that some definite plan will be formulated and upheld during the coming year.

CONTRACTING GRAPES. A large percentage of the grape growers contract their whole crop of grapes either to the buyer or wine manufacturer. The contracting is resorted to in order to insure a certain percentage of grapes before the market opens. The buyers usually contract at so much per basket for the different varieties or buy the whole vineyard at a flat rate per basket.

The wine manufacturers buy at so much per ton f.o.b. Grapes are picked and put in barrels, all fruit being taken. The different colored grapes are kept separate. In selling to the wine manufacturer the grower has very little trouble in the harvesting and shipping of his crop.

COST OF PRODUCTION OF ONE ACRE OF GRAPES.

As a sequent to the prices realized by the growers last year great interest has been shown in regard to the actual cost of production. Mr. Murray Pettit, who is one of our largest grape growers, and is considered an eminent authority on grapes, not only in Canada but also in the States, gave an address at the Convention of the Fruit Growers' Association in November, on the cost of producing and maintaining an acre of grapes, and also endeavored to prove that grapes were an unprofitable crop at 12c. per basket, and while there was some diversity of opinion with regard to his figures on the actual cost of production yet the consensus of opinion throughout the whole district is that the margin of profit at that price is too small to cover risks of hail or frost or variability of crop, and they all agree that the prices should be from 14 to 18c. per basket according to variety.

It must be taken into consideration in computing the cost of producing and maintaining an acre vineyard that there are two years in which the vineyard does not yield any crop. It is true that a crop may be grown the first year, but the percentage of land that may be utilized is small. The three crops used are corn, potatoes or tomatoes, but corn is not very highly recommended, as it shades the vines. Potatoes and corn do not give the very best results on the majority of grape soils. The cost of grape land varies very much, but the average would be about \$125 per acre.

First year.

Land	\$125 00
Fall preparation of land	3 00
Spring cultivating and marking furrows	1 50

Cost of 435 Vines at 4c.	17 40	
Planting	3 00	
Cultivating	3 00	
Fall plowing	2 00	
Interest on money invested at 5% (practically)	7 50	
Allowance for cropping		10 00
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Total expenditure for first year	\$162 40	10 00
Net expenditure for first year	152 40	

Second year.

Working soil in spring	1 50	
Cultivating	3 00	
Pruning and tying	1 00	
Interest on capital at 5%	7 50	
Cost of trellising—		
435 Posts at 15c. per post	65 25	
Planting 435 posts (including digging and setting posts) at 5c. per post	21 75	
Staples and Wire	10 00	
Wiring	2 00	
Interest	13 00	
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Total	\$125 00	

Third year.

Pruning	1 50	
Tying	50	
Cultivating and plowing	5 50	
Fertilizing	8 00	
Spraying twice	1 00	
Interest	14 70	
<hr/>		
	\$31 20	

Average crop for third year, 435 baskets per acre.

Cost of 435 baskets at \$34 per thousand	14 79	
435 Baskets at 12c.		52 20
Picking 435 at 3/4c. per basket	3 26	
Covering	1 00	
Delivery	75	
<hr/>		
	19 80	
Total expenditure for third year	51 00	
Total revenue		52 20

Total expenditure for first three years—above receipts:

First year	152 40	
Second year	125 00	
Third year	8 50	
Third year	1 20	
Management for 3 years at 5%	16 92	
<hr/>		

\$293 12

Fourth Year.

Pruning	\$3 00	
Tying	2 25	
Gathering and burning brush	50	
Spraying	50	
Plowing and cultivating	5 50	
Fertilizing	8 00	
Interest	15 73	
850 Baskets at 12c.		\$102 00
Cost of 850 baskets at \$34 per thousand	28 90	
Picking 850 baskets at $\frac{3}{4}$ c. per basket	6 37	
Covering	2 00	
Delivering	1 00	
	<hr/>	
	\$74 65	
Management	5 00	
	<hr/>	
	\$79 65	102 00
Profit	22 35	

INSECTS AND DISEASES.

The grape is perhaps freer from the devastation of insects and diseases than any other fruit grown in the Niagara district, and it is perhaps owing to this factor, together with the almost assured prospect of the production of an average crop every year, that the grape has been placed in the same relation to the fruit industry as grain may be said to hold in regard to general farming—namely, the staple crop.

While a good collection of insects may be gathered by a visit to all the vineyards in the Peninsula, yet I have not been able to locate any special insect which may be said to be the cause of any serious damage to the grape industry.

THE GRAPE VINE FLEA BEETLE, *Haltica chalybea*.—This is a little, shiny steel blue beetle about one-sixth of an inch long and appears during the early period of growth, and while it does not do any considerable injury in the Peninsula it is perhaps the most prevalent but is easily controlled with poisoned Bordeaux. This insect winters over under rubbish or near the roots of stumps of trees. The grower should always keep it under control as it is capable of doing a considerable amount of damage.

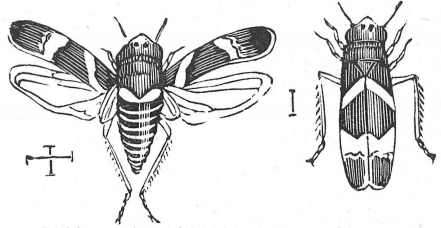
THE ROSE CHAFFER, *Macrodactylus subspinosus*.—This insect is a dull yellowish brown color, half an inch long, with long spiny legs. It is a very voracious feeder and will completely strip a vine or rose bush. It is not very common and seems to appear locally. I remember one case where this insect appeared on a farm near Burlington and did considerable damage to some of the vines. It is not easily controlled, as the poisons, especially Paris green, do not seem to have any effect on it. As soon as these insects appear they should be hand-picked and destroyed.

THE SPOTTED PELIDNOTA, *Pelidnota punctata*.—This is a large brown beetle something like the June Beetle, but has three black spots on each

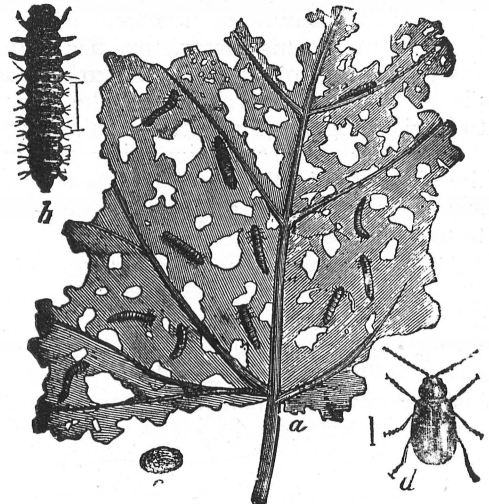
wing cover. It appears during July and eats the foliage. It succumbs to the poison, but it is so conspicuous that it is easily detected and should be killed when seen. This insect is quite prevalent but does not do any serious damage.



Grape-vine Flea Beetle (*Haltica chalybea*).



Grape-vine Leaf-hopper (*Ervthroneura vitis*).



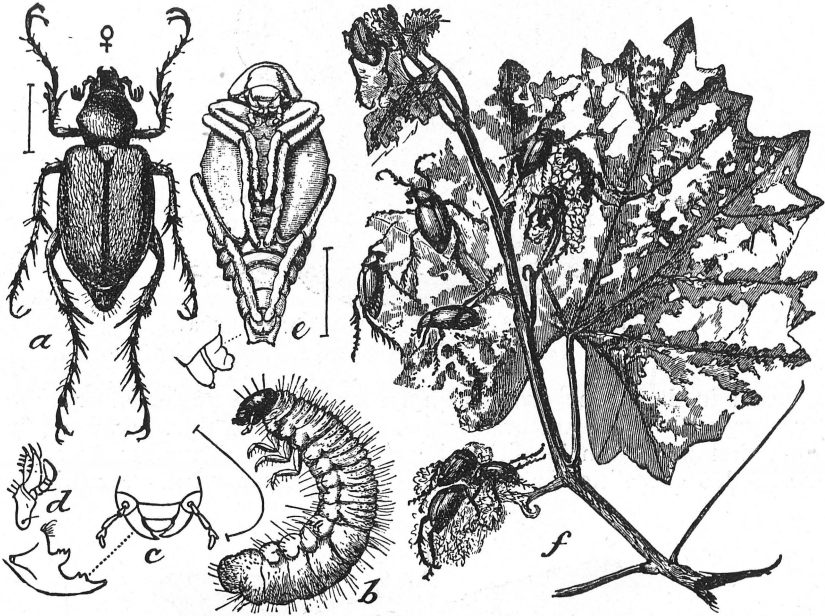
Grape-vine Flea Beetle (*Haltica chalybea*); *a*, Larvæ feeding; *b*, Larva; *c*, Pupa stage; *d*, Beetle.

THE GRAPE VINE SPHINX. According to Mr. T. D. Jarvis there are five species of the insect to be found in the vineyards, the commonest being the Green Grape Vine Sphinx. When the caterpillars are full grown they are about two inches long and are very noticeable. They are found occasionally in almost all the vineyards and may be hand-picked. The adult is a beautiful large moth, the fore wings expand about two and

one-half inches, of a velvety green color with dark bands. The hind wings are smaller and of a dusty red color.

There are several other caterpillars that appear in the vineyards, but have not been the cause of any serious loss. The following is a list of some: Grape-vine Leaf Roller, Grapevine Geometer, the Yellow Wooly Bear and species of cutworms.

THE GRAPEVINE LEAF HOPPER, *Typhlocyba vitifex*.—This insect is very prevalent in the vineyards of the Peninsula. It is very small, about one-eighth of an inch in length and may be found in great numbers on the under surface of the leaf, and when disturbed takes flight very



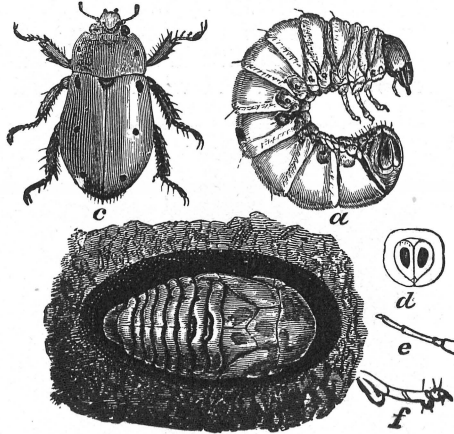
Rose Chafer (*Macrodactylus subspinosus*); *a*, beetle; *b*, larva; *c* and *d*, mouth parts of same; *e*, pupa; *f*, injury to leaves and blossoms with beetles, natural size, at work (after Marlatt, U.S. Dept. Agriculture).

quickly. The larvæ appear in June and moult several times. The moult-age may be found on the under surface of leaf. The larvæ resemble the adult, only smaller and wingless. They are sucking insects and can only be destroyed by contact insecticides, such as tobacco water, whale oil soap and kerosene emulsion.

GRAPEVINE PHYLOXERA, *Phylloxera vastatrix*.—This insect is very uncommon in our vineyards and is only occasionally found. The insect has two forms, one attacking roots, causing rotting and death, the other attacking the leaves, producing innumerable galls.

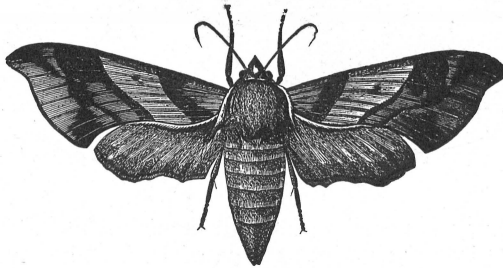
FUNGUS DISEASES.

BLACK ROT. This is perhaps the most dangerous enemy of the grape. It is prevalent and seems to appear locally and periodically throughout the district. This, however, may easily be explained as it seems only



The Spotted Pelidnota; *a*, grub; *b*, pupa; *c*, beetle.

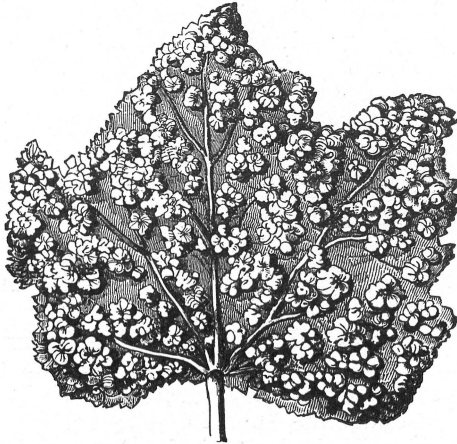
to appear in those vineyards which are kept in sod, neglected or improperly sprayed. There are one or two exceptions to this, because I have found that in certain localities the disease seems to appear every year. One of these localities is on top of the first escarpment, near Vineland.



Green Grape-vine Sphinx Moth.

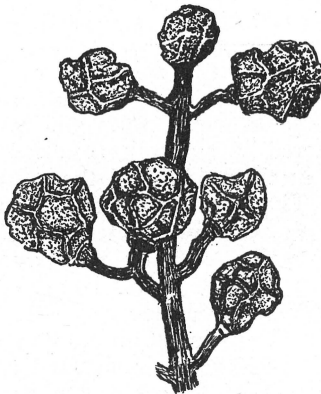
It is the opinion of some growers that it more frequently appears on dry, sandy elevations, but the factor which seems most favorable to its development is lack of atmospheric circulation, and I would strongly advise that vineyards should only be established on those positions of the farm which are not protected from the winds.

The growers as a general rule are aware of the tremendous damage that this disease will do in one night, but still many of them will not spray their grapes if they look clean. I have seen vineyards with very



Phylloxera Galls on Grape Leaf.

slight infections allowed to go unsprayed. This disease might quite easily be controlled by spraying with Bordeaux, but the spraying must be done before its appearance. When spraying after the disease appears, a minimum amount of lime should be used in neutralizing the bluestone,



Cluster of grapes affected with
Black Rot.

and I would strongly recommend the application of Bordeaux which has been made by neutralizing the bluestone with clear lime water rather than with the milk of lime.

The grower will probably first notice the disease in the fruit by one or two of the berries turning brown and gradually getting black. This will happen even when the berries are half grown. The berries will shrivel up and drop. When the disease has reached this stage it will make short work of the bunches. The first appearance is shown, however, in the leaves. Yellow spots appear near the vein of the leaves. It is often apparent, however, that the sun produces similar spots on the leaves, especially when they are tender. The yellow discoloration on leaves caused by the fungus is very noticeable in vineyards which are badly affected.

The fruit grower should destroy all diseased bunches and berries and not leave them to hang on vines, as is too often the case. He should also endeavor to keep the vineyard cleaner. If clean methods are adopted and the vineyard sprayed at least twice every year, little injury should result. The red varieties seem to be more susceptible and should be carefully sprayed.

DOWNY MILDEW, *Plasmopara viticola*.—This fungus is quite common. It attacks the fruit, leaves and young shoots. The bunches and underside of leaves become mouldy, being covered with a delicate white film. The greatest damage is done to bunches. The berries do not develop so well and the appearance of the bunch is far from inviting. This disease is easily controlled by two sprayings of Bordeaux and if necessary an application of flour of sulphur, which is dusted on the vines in the morning.

POWDERY MILDEW, *Uncinula spiralis*—Attacks the grape in the same way as the downy mildew, but is more especially found on the canes. When berries are affected they show brownish or blackish spots. It is quite common in the Peninsula and the same treatment as for downy mildew is effective.

There has appeared quite frequently in our vineyards an undesirable condition of the vines, which has not been attributed to any particular cause. It appears mostly on sandy soils and attacks all bearing vines. Its first appearance is noted by a peculiar mottled yellow discoloration of the young leaves, and in the middle of the growing season the whole vine will turn yellow. The vine loses its thriftiness and the fruit does not develop so well as on other unaffected canes. This malady may or may not appear in succeeding years on each vine, but it will always be found in the locality of the vine in which it first appeared. I have noticed vines to regain their normal color the year after being affected, and the following year again will show almost an extenuated form of the malady. One vineyard which I have in mind is situated near St. Catharines. In the vineyard the vines seemed to get worse every year and this year they were removed. This peculiar malady does not seem to spread very rapidly, and its periodic appearance would tend to indicate that it might be caused by the lack of some constituent in the soil.

SPRAYING GRAPES. Every vineyard should be sprayed at least twice every season, and the most successful vineyardist sprays three times.

There are, however, hundreds of vineyards that are not sprayed at all and a great many more that are only sprayed once. It is hard to explain the reason for this. The grape is considered one of the hardiest and most resistant of our fruits and the necessity of spraying depends to a great extent on the weather. Very often a grower will neglect spraying his vineyard one year and will reap a good clean crop, so he lets it go the next year without spraying. This is done even in cases where insects and diseases are found to a small degree. The grower does not seem to realize that this infection will gradually increase until the effect is strongly in evidence and considerable loss is sustained. After such an example the grower will spray for a few years and then again become lax. There is not a single vineyard in the whole district that has not been sprayed in which it is not possible to find the mildew or other diseases and there is no class of fruit which is so easily and cheaply sprayed as the grape, and perhaps no fruit which is more quickly destroyed by fungus diseases. The lack of spraying of grapes seems to be largely due to the lack of knowledge concerning diseases and insects affecting the grape, and to the extent of the damage done by such pests.

It must be fully understood, however, that only economical spraying is recommended, and not promiscuous spraying as previously mentioned. There are some seasons which require less spraying to protect vineyards, and an experienced grower will take advantage of this factor and perhaps save a few dollars, but this economizing should not be instituted until after the second spraying.

SPRAYS AND SPRAYING. As grapes are not affected with the San Jose Scale it is not necessary to spray with lime and sulphur. The mixture universally used is "Poisoned Bordeaux Mixture," which is simply bluestone, lime, and water, poisoned with one of the arsenical poisons. The formula generally used is 4 lbs. bluestone, 4 lime and 40 gals. water. This is poisoned with 2-2½ lbs. arsenate of lead, or 4-6 oz. Paris green. The bluestone is dissolved and put in the tank, which is about half filled with water. The lime is then thoroughly slaked, diluted and poured into the mixture of bluestone and water through a fine strainer, which removes the coarse particles. The poison is then made into thin paste, diluted and added to the mixture and the whole made up to the desired amount. Too great an excess of lime should never be used and the proportion of lime and bluestone should be adhered to.

Another form of Bordeaux Mixture which is used by one or two growers and which, I think, is greatly superior, is made in the following way: Forty lbs. of good stone lime is slaked in a barrel and thoroughly stirred after it is properly slaked. Great care must be taken in slaking not to drown or burn the lime by use of too much or too little water during slaking. The formula adopted in this mixture is 2½ to 3 lbs bluestone to 4 gallons of the clear lime water, which is got by allowing the lime to settle. The same amount of poison and water is used as in the standard Bordeaux. The mixture should always be tested with ferro cyanide solution and if any red air colouration add more lime water.

The value of this mixture is deserving more attention. In its manufacture only enough lime water is used to neutralize the bluestone and no lime sediment is present to clog the nozzles. The mixture is finer and more easily applied, and as there is no excess of lime the fungicidal action of the copper sulphate or bluestone is immediate and constant until the application has lost its utility by virtue of the chemical action of the moisture of the atmosphere on the ingredients of the Bordeaux mixture. I consider the availability of the fungicidal action of the copper salts a very important factor, for we may be sure that should the spores of the disease be present there will also be active Bordeaux mixture to combat their development.

WHEN TO SPRAY. Grapes should be sprayed for the first time just before the blossoms appear, when the grapes are about the size of B.B. shot and about three weeks later and as many times after this as the grower feels it will be profitable. Under ordinary conditions, three sprayings are all that are necessary.

SPRAYING MACHINERY. There are at present several makes of grape sprayers. There are small two-wheel carts with a tank of 80-gallon capacity, wheel power with horizontal arms to which are attached nozzles which may be turned in any direction. This outfit at first looks very admirably adapted to the work. It does away with the handling of rods and all there is to be done is to drive up and down the rows. There are a lot of growers who like this machine and use it extensively, but I have never been able to convince myself that the work is done as thoroughly as when a man handles the nozzles. In the early sprayings before the foliage is fully out a great deal of spray is wasted and when the foliage is fully out the spray does not seem to reach the inner portions of the vines. I think the most thorough and effective method of spraying a vineyard is to apply the spray with a rod and nozzle cluster. In this way the man may walk behind the spray cart and can apply the mixture whenever it is most desired and the work is done with greater efficiency.

VARIETIES.

In no branch of the fruit industry in the Niagara Peninsula is there such uniformity in the varieties grown as in grape growing. There are a few standard varieties that every grower plants and they stick to these with the result that any quantity of these varieties may be had at almost any shipping point. The Concords are far ahead of any other variety in popularity, followed by the Worden, Niagara, Rogers 9 and 15, Delaware and Moore Early.

EARLY GRAPES. A great difference of opinion prevails in regard to the advisability of planting early grapes. At one time Champions were destroyed because they were thought to be valueless, and yet on the top of all this our best growers have always made money from their early grapes.

Location is a great factor in deciding this question. Apart from the fact that every grower should have a few early grapes there are locations which, in my opinion, are better adapted for the production of early grapes than the late ones and will every year yield a greater profit. These special locations are found here and there in the western part of the Peninsula, and their presence is due to some special location, good drainage or physical condition of the soil, but in the eastern part of the peninsula, and especially in the township of Niagara, there is a large acreage of land situated on the first bench of the escarpment in the neighbourhood of St. David's, which offers every facility for the early production of grapes. The soil is admirably adapted and the fruit ripens from 5 to 10 days ahead of any other part of the peninsula. The result is that the early grapes command a high price. Mr. F. A. Goring goes in extensively for the production of early grapes; succeeds in putting his crop on the market ahead of the other sections and derives the benefit of a strong demand and high prices.

Of the early varieties of grapes there are three grown in the district—Champion, Moore Early and Campbell Early. The Champion is the earliest grape, is bluish black in colour, a medium sized round berry, thick skin and acid until very ripe. There is quite a diversity of opinion regarding the value of this variety. The flavor is poor, yet it is a good bearer and if left on vines until ripe, the quality is not bad.

MOORE EARLY is the best early grape; berries are large, round, black and thin skin; flavor is slightly foxy and flesh juicy. The vine is hardy, healthy and vigorous. It does best on light soils. It does not make enough wood on heavy soils. The yield is about two tons per acre.

CAMPBELL EARLY. The berry is large, black, blue bloom, tough, rich flavor, flesh sweet, tender, seeds small; bunches do not fill out; is preferred by some growers to any other early grape.

GRAPES FOR MAIN CROP.

WORDEN.—Large compact bunch, large, black, thin-skinned berry with heavy bloom; flesh sweet; berry cracks easily and is not a good shipper or keeper. Good for home market. Its flavor is superior to Concord. It is hardy and a good grower. Yield $3\frac{1}{4}$ tons per acre.

DELAWARE.—The best table grape grown; bunch small, compact and shouldered; berry small, round, beautiful red, thin skin, whitish bloom, sweet delicious flavor. Vine is healthy and of fair vigor; does well on great variety of soil and is quite hardy. Too much wood should not be left as it is short jointed. Will overload if too much wood is left, with the result that the fruit will not ripen. Yield $2\frac{1}{2}$ tons per acre.

CONCORD.—The most valuable commercial variety; very prolific; strong grower; heavy, thick foliage which seems to enable it to resist the frost in the spring; less susceptible to black rot; bunch is large, compact, five to six inches long; berry large, round, black with heavy bloom;

skin thick; flesh pulpy; flavor good when ripe; splendid shipper; yield $3\frac{1}{2}$ tons per acre.

NIAGARA.—The best white grape; bunch very large, compact and shouldered; berry round, medium-sized with whitish bloom; skin tough; pulp soft, juicy and sweet; flavor good, possessing a delicate muskiness when fully ripe. Vine is very vigorous and hardy, does well on variety of soils, but more inclined to black rot on light soils. Color pale yellow and whiteish yellow on light soils; yield $3\frac{1}{2}$ tons per acre.

LINDLEY OR ROGERS No. 9.—Large red grape, splendid flavor, thin skin, splendid shipper; does best on mountain wash soils; strong, vigorous grower; should be trimmed to seven buds to the arm. This variety is a poor fertilizer, the bunches not filling out enough; it is one of the best varieties; yield $2\frac{1}{2}$ tons per acre.

AGAWAM—ROGERS No. 15. Vine strong grower, productive; wood long jointed, should have long pruning; bunch large and compact, shouldered; berry large, thick skinned, brownish red; flavor very good; good shipper; inclined to be subject to black rot and mildew.

VERGENNES.—The best grape for winter use, large red berry, tough skin, juicy, good flavor, medium sized bunch; like Champion it bears five to six bunches to a bud, therefore should be trimmed short to five or six buds to a cane, if not it will overload and not ripen fruit. The vine is vigorous, healthy and productive and does best on the heavier soils; yield about 3 tons per acre.

BRIGHTON.—This is a beautiful red grape with an excellent flavor and of medium size; the bunch is large, shouldered, fairly compact and attractive looking. It is very hardy, healthy and vigorous, but slightly subject to mildew, very productive, but should be planted near other varieties that are good pollinizers. The season is medium and the variety only a fair keeper, but it is valuable for home markets.

In writing this article my aim was to explain as explicitly as possible the conditions of the grape industry in the Niagara District, and to describe the methods which are now in vogue. The fruit growers gave me every assistance that was in their power, and I take this opportunity to thank them, especially those whose names I take much pleasure in mentioning: Messrs. F. G. Stewart, R. Thompson, J. E. Henry, E. J. Smith and F. G. H. Pattison. On the whole, the grape industry is in splendid condition, and more uniform excellence has been obtained in this branch of the fruit industry than any other. There are three outstanding features which seem to have been neglected. First, proper attention has not been paid to the physical condition of the soil. This is especially so in the clay lands. Second, spraying has been more or less neglected. Third, much carelessness is displayed in the handling of the fruit by the growers.

While these defects may appear to be very great and would give the impression that the growers are very lax, on the other hand, scores of growers are up to date and treat their vineyards with every care, recognizing that these produce a very valuable staple crop.

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